Command and control … (C2) of air power has unique characteristics that reflect the way that professional airmen fly and fight. It is therefore vital that all members of the Royal Australian Air Force understand the Air Force’s C2 system.

When the Air Force, the Royal Netherlands Air Force (RNLAF) and several allied nations introduce the F-35 into service, it will bring new capabilities such as stealth and advanced sensor-fusion. This will require the development of new concepts for command and control (C2), and intelligence, surveillance and reconnaissance (ISR) to use the F-35 to its full potential.

The F-35 will present the operator with an unprecedented level of situational awareness (SA) through its inherent ISR capability. The enhanced SA will assist the exercise of C2 at the tactical level. This SA could also be extended across the force at tactical, operational and even strategic levels. This enhanced force-wide SA will enable commanders and operators to respond to emerging threats and opportunities rapidly, thereby controlling operational tempo and enhancing agility.

Enhanced agility also requires decentralised execution. This could be considered a new concept, as it facilitates the empowerment of subordinate units. Two essential enablers of this concept are collaboration, and information and communication technology (ICT). Without the means for units and operators to collaborate in near real-time, it will be hard, if not impossible, to effectively employ the concept of distributed control. In turn, near real-time collaboration needs support by robust and redundant ICT, especially if the new concept of C2 and ISR is being employed in a contested environment.

The above concept can be moulded into a framework for 5th-generation C2 and ISR that will assist both the RAAF and RNLAF to employ the F-35 to its full 5th-generation potential and ultimately enhance operational agility.

In addition to the introduction of the F-35, the following trends are also driving a major rethink of command and control of air operations:

- the emergence of long range and very fast missile threats,
- the ever-increasing demand for bandwidth to support military operations and the parallel development of increasingly sophisticated means to disrupt and/or deny access to that bandwidth, and
- the proliferation of sensor systems and the consequential need to analyse and make sense of huge volumes of data—the ‘big data’ problem.

These are but three of a larger number of challenges that are likely to confront commanders and operators.
in the next few decades. As much as the F-35, they are hallmarks of the information age.

In order to understand this new age, it is necessary to ask, ‘what has changed?’ At its most basic, it could be argued ‘not much’. John Boyd’s famous OODA loop—observe, orient, decide, act—is as relevant today as it was when first conceived. It is an elegant model which transcends the technology of the day because it describes an essentially human process that can be applied to every human activity.

Chief Information Officer Group’s *Networked Warfare Reference Architecture* depicts the process succinctly, as shown. In a warfighting context, the observe phase is essentially a machine process, where sensor data is correlated and fused by machines in accordance with complex algorithms. This sensor data is then ‘oriented’ or contextualised through a complex process involving both machine and human cognitive functions. Machines may, for example, perform pattern matching by comparing the newly acquired sensor data with historical reference data. For example, in an air surveillance scenario, a new air track might be compared with thousands of historical air tracks on the basis of its three dimensional position, heading, vertical and horizontal speed to refine its status. Simultaneously, a human operator may receive specific intelligence information about that same track, facilitating even greater refinement of its status. The challenge at this point is to present the amalgamation of all that is known about an entity—be that real-time sensor data or an intelligence snippet several hours old—to the decision-maker in such a way as to maximise his/her situational awareness to beyond that of their adversary.

In the information age, the ‘decide’ stage of the OODA loop is shaping up as the real battleground where the battle, campaign or war will be won or lost. To prevail on the contemporary battlefield, one must attain decision superiority, which means making better decisions than the adversary; better in terms of both their relative quality and speed. The ability to make relatively faster decisions is of the essence.

The *Networked Warfare Reference Architecture* describes decision superiority as requiring both an information and a cognitive advantage. In other words, it needs sufficient quantity of timely, accurate and relevant information to minimise situational uncertainty and it also needs decision-makers with the cognitive capacity and agility to exploit this advantage to deliver ‘better’ decisions than the adversary.

This then is the goal of the Air Force’s Future C2 Study which is being undertaken in cooperation with MITRE Corporation. The study is a review of Air Force’s C2 structure and processes to ensure that they afford the force of 2025 the best chance of attaining and retaining decision superiority. The study forms part of Plan *Jericho’s Program of Works*, and will develop and test different C2 approaches with a view to recommending one or more C2 models for the future force. Interoperability with the other Services and with Australia’s allies will remain a fundamental requirement of any proposed model. Models will be differentiated by the extent to which they delegate decision-making authority forward and by their reliance or otherwise on reach-back to higher authorities.

The very fact that Air Force is investing in a Future C2 Study acknowledges the central role effective C2 will play in exploiting the full potential of the future force. Innovative thinking on how best to achieve this will be the next challenge.

**Key Points**

- Effective employment of the F-35 will require the development of new concepts for C2 and ISR.
- New concepts of C2 and ISR will need real-time collaboration and robust and redundant ICT as well as adequate professional mastery in the force.
- New concepts of C2 and ISR could be based on the need to employ the idea of ‘distributed control’ which will enhance operational agility.